Code No: M0222/R07 **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, March 2013
POWER SYSTEM ANALYSIS
(Electrical & Electronics Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. Explain with examples (Taking atleast 4 nodes and 6 elements):
   (a) Cut-set matrix
   (b) Tie-set matrix. [16]

2. Form the Z_{bus} for the given network connections: [16]

Self		Mutual	
Bus code (element)	Impedence	Bus code	Impedence
1-2 (1)	0.6		
1-3	0.5	1-2 (1)	0.1
3-4	0.5		
1-2 (2)	0.4	1-2 (1)	0.2
2-4	0.2		

3. In a converged load flow explain how real and a reactive flow, injections, losses and slack bus power is computed. [16]

4. Formulate the N-R (Rectangular form) load flow problem. Explain its solution. [16]

5. (a) A 3 phase fault through fault impedance $Z_f = 0.08$ occurs at point F on the system shown in figure 5. The system is operating at noload and rated voltage. Determine bus voltages and line currents during the fault.
   (b) State the assumptions made in short circuit analysis. [10+6]

Figure 5

6. (a) Symmetrical components of a set of unbalanced 3 phase voltage are $V_0 = j0.6$; $V_1 = 0.866 + j0.5$; $V_2 = 0.693\text{-}j0.4$ A. Determine original unbalanced phasors.
   (b) Explain the significance of positive, negative and zero sequance components. [10+6]

7. (a) A transmission line has generalized circuit constants
   A = 0.93 + j0.016; B = 20 + j140.
   Find steady state stability limit if $|V_S| = |V_R| = 220KV$
   (b) Define "synchronizing coefficient". [16]

8. A 50 Hz, 500 MVA, 400 KV generator (including transformer) is connected to a 400 KV infinite bus bar through on inter connector. The generator has H = 2.5 MJ/MVA. Voltage behind transient reactance 420 KV and supplies 460 MW. The transfer reactance between generator and bus bar under various conditions are Prefault = 0.5 pu; During fault = 1.0 pu; Post fault = 0.75 pu.
   Calculate swing curve using ΔT = 0.05 sec, with fault cleared at 0.1 secs. The period of study is 0.2 secs. [16]

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Code No: M0222/R07 **Set No. 2**

IV B.Tech I Semester Supplementary Examinations, March 2013
POWER SYSTEM ANALYSIS
(Electrical & Electronics Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Compare Y_{bus} and Z_{bus} along with applications? Explain why Y_{bus} is more popularly used in CMPS? [16]

2. Form the Z_{bus} for the given network connections (take bus 1 as reference). [16]

	Self		Mutual	
Element	Bus code	Impedance	Bus code	Impedence
1	1-2	0.6		
2	1-2	0.4	1-2 (1)	0.2
3	1-3	0.5		
4	2-4	0.2		
5	2-4	0.4	2-4 (4)	0.1
6	3-4	0.5		

3. Why direct simulation of load flow is not possible? and mention data required for load flow solution? [16]

4. With the help of flow chart explain computational procedure used to conduct load flow study using N-R (Polar form) method. Consider all types of buses. [16]

5. (a) Show that p.u impedance of a transformer referred to either HV or LV side is same.

   (b) Draw p.u impedance diagram of the network shown in figure 5. Choose base quantities in transmission circuit. [6+10]

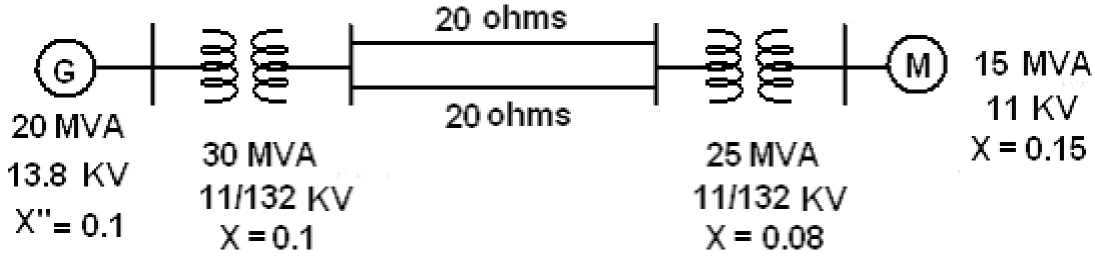

Figure 5

6. (a) P_{abc} is 3 phase power in a circuit and P_{012} is power in the same circuit in terms of symmetrical components. Show that $_{abc} = _{012}$.

   (b) The line currents in a 3 phase supply to an un balanced load are respectively $I_a = 10 + j20$; $I_b = 12 - j10$; $I_c = -3 - j5$ Amp. phase sequence is abc. Determine the sequence components of currents. [8+8]

Code No: M0222/R07 **Set No. 2**

7. A 3 phase 50 Hz transmission line is 200 Km long. The line parameters are r = 0.1 ohm /Km; $x = 0.25$ ohm/km; $y = 3 \times 10^{-6}$ mho / Km. The line is represented by nominal π model. $I_f \, |V_S| = |V_R| = 200KV$ determine steady state stability limit. [16]

8. (a) Explain the methods of improving transient stability.

   (b) A 50 Hz synchronous generator with inertia constant H = 4 MT/MVA and x'_d equal to 0.15 pu feeds 1.0 pu power to an infinite bus at 0.8 pf lagging. Via a network with an equivalent reactance of 0.3 pu. A 3 phase fault is sustained for 100 milli seconds at the terminals. Plot swing curve through t = 0.25 secs. [8+8]

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Code No: M0222/R07

Set No. 3

IV B.Tech I Semester Supplementary Examinations, March 2013
POWER SYSTEM ANALYSIS
(Electrical & Electronics Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Form the network matrices Z_{loop} using non-singular transformation for the network connections: [16]

element	p-r
1	1-2 (1)
2	1-2(2)
3	1-3
4	2-4
5	3-5

Self

Bus code	Impedence
1-2	0.6
1-3	0.5
3-4	0.5
1-2(2)	0.4
2-4	0.2

Mutual

Bus code	Impedence
1-2(1)	0.1
1-2(1)	0.2

2. Write the algorithm for the formation of bus incidence matrix for a branch case and form the Z_{bus} for the given network connections. [16]

Element	Bus code	Impedance
1	1-2	0.2
2	1-4	0.4
3	2-3	0.4

3. Discuss input and various outputs of load flow analysis using GS method. [16]

4. (a) Derive the equations to calculate line flows, line losses and slack bus power of a power system.
   (b) Distinguish between Decoupled method and fast decoupled method of load flow methods. [8+8]

5. (a) What are the advantages of p.u system.
   (b) For the network shown in figure 5b draw p.u impedance diagram. [10+6]

Code No: M0222/R07 **Set No. 3**

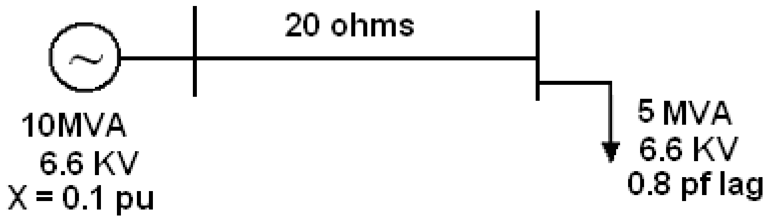

Figure 5b

6. (a) For the system shown in figure 6 draw the zero sequence network.
   (b) Explain why voltage source is not present in negative seq. network. [16]

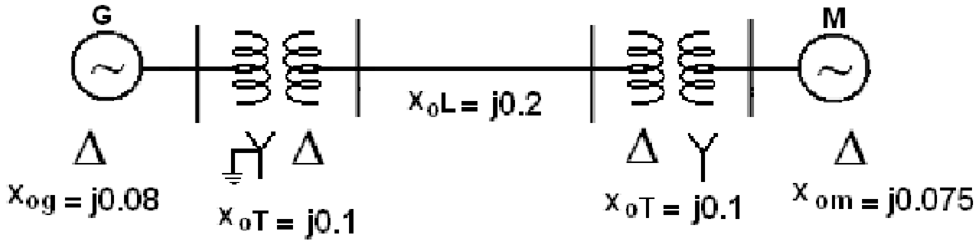

Figure 6

7. (a) Define stability.
   (b) A 3 phase line is 400 Km long. The line parameters are
   r = 0.125 ohm/Km; x = 0.4 ohm/Km and $y = 2.8 \times 10^{-6}$ mhos/Km.
   Find steady state stability limit if $|V_S| = |V_R| = 220KV$. [8+8]

8. (a) Define transient stability.
   (b) A generator having H = 6.0 MJ / MVA is delevering 1.0 pu to an infinite bus via a purely reactive network. When occurrence of a fault reduces the generator output power to zero. The maximum power that can be delivered is 2.5 pu. When the fault is cleared the original network conditions again exists. Determine critical clearing angle and critical clearing time. [4+12]

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Code No: M0222/R07 **Set No. 4**

IV B.Tech I Semester Supplementary Examinations, March 2013
POWER SYSTEM ANALYSIS
(Electrical & Electronics Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. Form the Z_{br} non-singular transformation for the network connections given below:

element	p-r
1	1-2 (1)
2	1-2(2)
3	1-3
4	2-4
5	3-5

Self

Bus code	Impedence
1-2	0.6
1-3	0.5
3-4	0.5
1-2(2)	0.4
2-4	0.2

Mutual

Bus code	Impedence
1-2(1)	0.1
1-2(1)	0.2

2. Write the algorithm for formation of bus impedance matrix for addition of branch case:
   (a) To the reference node
   (b) To a non reference node. [16]

3. Show that when there is no mutual coupling, the diagonal and off-diagonal elements in the Y_{BUS} matrix can be computed from the formula:

   $Y_{ii} = \sum_{j=1}^{n} yij$

   Y_{ij} = - yij

   Where y_{ij} represent admittance between buses i and j and Y_{ii} is the admittance between bus 'i' and ground bus. [16]

4. Derive necessary expressions for the off-diagonal and diagonal elements of the sub-matrices J_1, J_2, J_3 and J_4 for carrying out a load flow study on power system by using N-R method in Polar form. [16]

5. (a) Prove that $Z_{pu(new)} = Z_{pu(old)} \times \frac{(MVA)_{Base(new)}}{(MVA)_{Base(old)}} \times \frac{(KV_{LL})^2_{Base\ old}}{(KV_{LL})^2_{Base\ old}}$
   (b) Obtain pu impedance diagram of the power system of figure 5. Choose base quantities as 15 MVA and 33 KV.

Code No: M0222/R07 **Set No. 4**

Generator: 30 MVA, 10.5 KV, $X'' = 1.6$ ohms.
Transformers T_1 & T_2: 15 MVA, 33/11 KV, X = 15 ohms referred to HV
Transmission line: 20 ohms / phase
Load: 40 MW, 6.6 KV, 0.85 lagging p.f. [4+12]

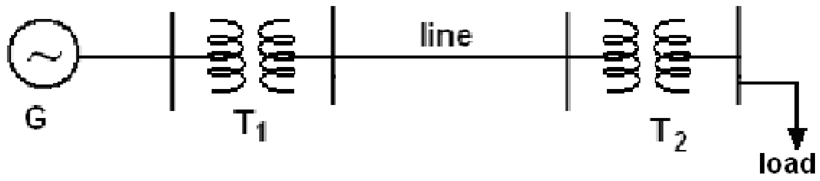

Figure 5

6. (a) The voltages across a 3 phase unbalanced load are $V_{ab} = 300\ V\angle 0$; $V_{bc} = 300\ \angle{-90^0}$; $V_{ca} = 800\ \angle 143^0$ respectively. Determine the sequence components of voltages.

   (b) Symmetrical components of unbalanced 3 phase currents are $I_0 = 3\ \angle{-30^0}$; $I_1 = 5\ \angle 90^0$; and $I_2 = 4\ \angle 30^0$. Obtain original unbalanced phasors. [8+8]

7. A 50 Hz synchronous generator with H = 2.5 MJ / MVA supplies power to infinite bus as shown in figure 7. Derive an expression for power delivered to infinite bus and plot power angle curve. [16]

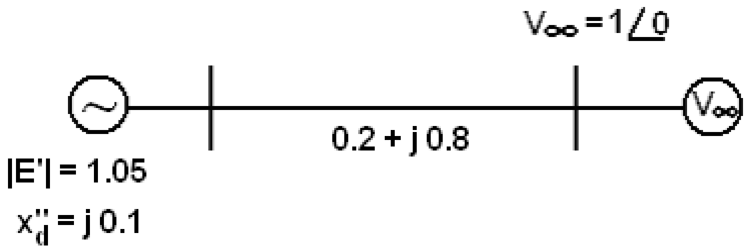

Figure 7

8. (a) State and justify the assumptions made in deriving swing equation.

   (b) A generator having H = 6 MJ / MVA through a reactive network. The generator is delivering power of 1.0 pu to the motor, when a fault occurs which reduces delivered power to 0.6 pu. Determine angular acceleration of the generator with respect to motor. [6+10]

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